### **LANDUSE**

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#### **Historical Land Use**

The first recorded inhabitants of the basin were Native Americans who called themselves the Osage (originally pronounced Wha-zha-zhe) which meant <u>Little Ones of the Middle Waters.</u> They were descendants of Asian people who came across the Bering Strait during the Ice Ages. The life of the Osage people followed a yearly cycle that depended on agriculture, food gathering, and hunting. Rivers, streams, and creeks were important factors in their lives. Family groups wintered in lowlands near rivers. They moved to the plains in the spring where they planted gardens of corn, beans, and pumpkins. In the summer, the families moved to the tall grass prairies, their hunting grounds, so the men could hunt and women could preserve the animals taken. In late summer, they returned to the plains to harvest their gardens. In the fall, they would return to their hunting grounds for another hunt. They would then return to their villages along the rivers for the winter. The native Osage people also supplemented their diets with wild fruits, walnuts, hazelnuts, pecan, acorns, grapes, plums, persimmons, and numerous roots.

It is estimated that there were approximately 5,000 people in the Osage tribe when the Europeans began entering the basin. The Osage people had little influence on their environment by today's standards with one exception. The Osage tribe, as did many plains tribes, used fire to combat their enemies, to drive wild game, and attract wild game. The burning of grasslands was used to scare animals to points of easy capture. Also the new succulent vegetation that would grow a few weeks after a fire had swept through an area would attract wildlife and increase the value of hunting grounds. Large scale burning was commonly practiced among the tribe. This burning had the major influence of suppressing the forest ecosystem and stimulating, expanding, and maintaining a prairie/savannah/glade based ecosystem over the areas of the basin where burning was practiced. At the time the Osage tribe occupied the area, prairies were located in the uplands of Cole Camp Creek, Turkey Creek, Dry Auglaize Creek and Wet Glaize Creek subbasins (Schroeder 1983).

The first Europeans to explore the area were the French. In 1714, The French explorer Etienne de Bourgmond explored the Missouri River and may have been one of the first Europeans to see the Osage River and parts of its basin. The French were primarily interested in trading furs and establishing fur trading routes. When the first settlers moved into the Osage Basin they found magnificent stands of timber inhabited by forest game. Furbearers were abundant, as were grassland birds and mammals. Buffalo and elk were common to the basin as were black bear, wolves, and mountain lions. Passenger pigeons inhabited the woodland areas. Many of these animals played an important role in the pioneer economy of the basin in the form of food to eat and fur to trade. Fur trading was a major economic activity in the basin. Some settlers trapped while others traded with the Osage people. Deer and beaver were the two most popular furs.

The East Osage River Valley was part of a larger land claim by the French in 1682.

At that time, it was called Louisiana in honor of King Louis XIV. In 1762, the basin was ceded from

France to Spain. During the 1700's the population of all of Missouri probably did not exceed 2,000 Europeans. These were congregated along the edges of rivers. In 1800, the Spanish ceded the basin back to France. In 1803, the United States of America purchased the basin from France. Zebulon Pike, in 1817, led the first recorded European exploration of the basin.

The early Europeans described the native Osage people as handsome, well-built, and striking. They were thought to be fierce-looking when tattooed. Heights over 6 feet were common. Generally, the native Osage people were cooperative with the Europeans and they did not slow the expansion of settlers into the basin. The Osage people signed treaties waving their claims and opening the way to westward expansion. Much of the basin as well as surrounding basins were ceded to the United States by the Osage people in 1808. For twenty more years, however, the Osage people continued to hunt over much of the basin.

In 1837, the first steamboat ascended the basin. However, low water hindered navigation by steamboats. In 1841, the U.S. Congress gave the state of Missouri funding to proceed with river navigation improvement projects. Some of these projects consisted of building dams of brush and stone and digging and scraping the river channel. These dams extended diagonally across the Osage River to confine the river channel to one bank.

In addition to the dams, snags were removed, overhanging trees were cut as a hazard to the high smokestacks of the steamboats. Maintenance of the river for navigation was costly. In less than twenty years, the river navigation program was taken over by the Federal Government and maintenance for navigation remains today the responsibility of the USACE.

Navigational projects were common on the river until the Civil War, after which the completed railroads began to become more important for travel in Missouri. The coming of the railroads signaled the beginning of the end for steamboat travel in Missouri.

Since the basin's first highways were its rivers and streams, early towns were typically built next to waterways. The towns of Linn Creek and Warsaw prospered as shipping terminals for steamboats. As settlers moved into the basin, they cut timber and delivered it downstream to larger towns. The basin was part of the largest timber producing region in the nation at the end of the 1800s.

Timber was cut for railroad ties and assembled into rafts and floated to the railhead at Bagnell, Missouri. Railroad ties were cut from as far back as 15 miles from the river. Tie squares were created by nailing 35 to 36 ties side by side to create a square eight feet wide. Some tie rafts were as much as 1,200 feet long, consisting of 35 or more tie squares. A raft of tie squares might be so large as to cover three bends in the river. It was in this fashion that the settlers moved the railroad ties down the river.

In 1906, a lock and dam was constructed on the Osage River to facilitate river travel. By the late 1920's, the forest of the basin had become exhausted of its resources. All that was left over much of the basin were rocky, barren hills. Cleared areas were used to grow a few crops, livestock were left to free-range, and settlers burned any remaining woods. Gravel had eroded from many of the hillsides and streams became choked with gravel.

With such an enormous amount of water in Missouri, it wasn't long before people began looking for ways to harness some of that potential energy for human use. In 1912, Ralph W. Street of Kansas City began to study the concept of damming the Osage River. In the fall of 1924, a preliminary permit was issued for the project. At this same time, the Missouri Hydro-Electric Power Company was also incorporated in

Missouri. Construction of Bagnell Dam began immediately after receiving the permit. Many facilities were created including an enormous mess hall, an administrative building, a large warehouse, and a power house. A road was built from the site of the dam to Bagnell, and the railroad from Bagnell to the dam site was mostly finished. The largest power contract to that date was negotiated, involving the sale of more than 150 million kilowatt hours to the St. Joseph Lead Company in the southeastern portion of Missouri.

Skeptics of the project abounded, saying that the project simply seemed impossible. The sheer scale of the dam itself was, after all, huge even by today's standards. Nevertheless, the local residents observed, gripped by excitement, as Union Electric began its initial clearing on August 6, 1929. Many thousands came seeking employment. Construction of Bagnell Dam provided more than 20,500 jobs at a time when the country was still in the grips of the Great Depression.

Bagnell Dam was completed in 1931. Electric service began on Christmas Eve of that year. With the completion of Bagnell Dam commodity transport on the upper river had come to an end. Bagnell Dam limited commercial navigation to the lower 82 miles of the Osage River. Bagnell Dam is 2,543 feet long, projects 148 feet above the bedrock, and creates a 55,000 acre reservoir with 1,300 miles of shoreline. The lake impounds 87 billion cubic feet of water. At the time the lake was built, Lake of the Ozarks was the largest man-made lake in the United States and one of the largest in the world (Pilkington 1989).

#### **Recent Land Use**

The current human population of the basin is larger than in previous years and is expected to increase in the foreseeable future (Table 3). The counties of Camden, Benton, Hickory, Morgan, and Pulaski are all expecting a greater than 5% increase per 5-year period based on population census records. The county which is expecting the most significant increase in population growth is Camden County with an expected 10-12% increase per 5-year period (Missouri State Office of Administration 1998).

Numerous communities exist within the basin (Figure 7). There are 10 communities in the basin with populations greater than 1000 (Table 4). The largest community is Lebanon found on the southernmost tip of the basin with a population that approached 10,000 in 1990. Other large communities found along the perimeter of the basin include Eldon, Crocker, Dixon, Richland, Warsaw, Cole Camp, and Versailles. The largest communities which are contained entirely within the basin are Camdenton and Osage Beach. Both of these resort communities are located adjacent to Lake of the Ozarks.

The majority of the current population growth of the basin can be attributed to the booming recreation and tourism industries. The recreation and tourism industry of this area centers around Lake of the Ozarks.

#### **Recreation**

Lake of the Ozarks has grown into the state's largest resort development and is considered one of Missouri's top tourist areas (MDNR 1985). Recreation is Lake of the Ozarks number one industry and a major retirement destination. Lake of the Ozarks offers ample opportunities for vacationing, fishing, boating, and waterskiing. Lake of the Ozarks was the first lake in Missouri to offer such activities on such

a large scale. The recreational opportunities found at the lake have also led to the development of the shoreline and surrounding communities into a myriad of vacation homes, condominiums, hotels, restaurants, and shopping districts. With this growth has come a new emphasis on preserving the lake's unique environment for future generations.

Anglers account for nearly 1 million trips to Lake of the Ozarks per year, or about 14% of all fishing in Missouri (Stoner 2000). Fishing alone benefits the lake area economy by more than \$70 million per year (Weithman 1991). Some of the more popular gamefish of Lake of the Ozarks include black bass, crappie, catfish, walleye, white bass, striped bass, striped bass x white bass hybrids, and paddlefish (Stoner 2000).

An average year will see at least 450 boating associated events including regattas, fishing tournaments, parades, and boat-shows on Lake of the Ozarks. Surrounding streams and rivers also provide a location for many boating, canoeing, sightseeing, and other passive leisure-time activities.

Other recreational activities that occur in the basin include swimming, hunting, camping, spelunking, golfing, and horseback riding. Camping takes place on some of the public areas where it is permitted and also at privately owned and operated campgrounds. Horseback riding is permitted on some designated trails of Lake of the Ozarks State Park.

#### **Land Cover**

Land cover within the basin is principally forest (54.8%) and grassland (39.7%) (Table 5, Figure 8). Open water makes up 2.5% of the basin while cropland makes up 1.6% and urban areas make up 1.4%. Most subbasins of the East Osage River Basin area are similar in that they are all principally made up of forest and grassland. The upper Lake of the Ozarks Hills Subbasin has the largest percentage of forest cover with 72% of this subbasin covered with forest. The Turkey Creek Subbasin has the largest percentage of grassland with 58.7% making up this Subbasin. The Lower Lake of the Ozarks Hills Subbasin has the largest percentage of open water with 19.7% or 30,332 acres open water. The Dry Auglaize Creek Subbasin has the largest percentage of urban land cover with 5.8% or 7,550 acres in urban areas.

#### Agriculture

Major current agricultural activities for counties in the basin are livestock production and crop production according to the Missouri Agricultural Statistics Service. Major grain crops produced in the basin include corn, soybeans, sorghum, and wheat. Benton County was the top grain crop producing county within the basin in 1998 with approximately 36,000 acres of grain crops, the majority of which were soybeans. The next top producing county for grain crops was Morgan County with approximately 10,000 acres of soybeans, 7,500 acres of corn, and 3,300 acres of sorghum. The lowest grain crop producing county in the basin was Camden County in 1998. It is clear that the counties within the basin have experienced a downward trend over time in crop production – an example of which is presented for Miller and Camden Counties (Figure 9). During the past century, Miller County corn production has dropped from almost 40,000 acres of corn produced in 1909 to only 1,300 acres in 1998. In Camden County, corn produced dropped from almost 34,000 acres to less than 500 acres in 1998. All other counties within the basin experienced similar declines in grain crop production (MASS data 2001).

Other important crops currently produced within the basin are fescue seed and hay. The top hay producing county of the basin was Laclede County with 58,100 acres of hay harvested in 1998. All counties of the basin produced significant amounts of hay. The average of amount of hay produced by a county of the basin was 37,540 acres.

Because of its high tolerance to stress, tall fescue (KY31 variety) is the main grass used for pastures and hay in the basin today. KY 31 fescue, however, has deleterious effects due to an associated endophyte present within the plant. The endophyte causes reduced weight gain of livestock as well as poor blood circulation, elevated temperature, and other health problems.

Tall fescue also can form a low-growing dense sod. In its sod-bound stage, it does not provide suitable habitat for some wildlife species including quail and other native grassland birds.

Native bunch grasses such as big bluestem, little bluestem, side oats grama, and Indian grass were more widespread throughout the basin before European settlement. These grasses are still found in prairie, glade, and savannah areas of the basin (Allgood and Porringer 1979).

Major livestock commodities within the basin are beef cattle, milk, and hogs. Beef cattle production consists primarily of cow-calf operations, stocker operations, concentrated feeding operations or a combination of these. Head of beef cows per county ranged from 12,700 head in Pulaski County to 33,400 head in Osage County in 1999. There was an average of 22,220 beef cows per county in the basin. Head of dairy cows per county ranged from 300 in Pulaski County to 2,250 head in Hickory County. Similarly all counties within the basin produced a significant number of pasture acres with 96,829 acres in Pulaski County to 206,829 acres in Laclede County. Hog numbers ranged widely from county to county with only 3,000 head in Laclede to 77,300 head in Osage.

Most counties within the basin have experienced an increase in cattle numbers over time (MASS data 2001) - an example of which is presented for Miller and Camden Counties (Figure 10). Total numbers of cattle in Miller County have steadily increased from only 5,174 in 1850 to 57,000 head in 1999. Similarly in Camden County, the number of cattle has increased from 14,100 head to 30,300.

Hog numbers have increased over time in Miller County but declined in Camden County (Figure 11). The increase in swine numbers in Miller County is in part due to a coinciding increase in CAFOs in that county in recent years. Swine numbers in Miller County have risen from 16,800 in 1940 to 98,600 in 1999. In Camden County where there are no swine CAFOs, swine numbers dropped from 19,237 in 1910 to 7,200 in 1999.

#### **CAFOs**

The MDNR issues permits and regulates activity of CAFOS within the basin. The MDNR recognizes 4 types of CAFOs based on the number of animal units. A facility with 7,000 or more animal unit equivalents is designated as class IA. Class IB facilities have 3,000-6,999 animal unit equivalents. Class IC facilities have 1,000-2,999 animal unit equivalents. Class II facilities are those with 300-999 animal unit equivalents. Class IA, IB, IC, and II facilities are considered point source pollution facilities. Only class IA, IB, and IC facilities are regulated by MDNR. Facilities with fewer than 300 animal units are considered non-point source pollution sources and are not regulated.

There are 70 different permitted CAFOS within the basin (Figure 12). The majority of these are located in the Miller County River Hills and the Tavern Creek Subbasins with 19 in each of these subbasins. Basin-wide there are 45 Swine CAFOS. This is more than any other type of CAFO within the basin. The other CAFO types within the basin are the turkey CAFOs (n=14), dairy CAFOs (n=8), and poultry boiler CAFOs (n=3). All of the poultry boiler CAFOs are located within the Cole Camp Creek Subbasin and this is the only type of CAFO located within this subbasin. Other subbasins with numerous CAFOs are the Lower Osage River Hills Subbasin and the Wet Glaize Creek Subbasin. Subbasins with only a few CAFOS include the Lower Maries River Subbasin, the Little Maries River Subbasin, Dry Auglaize Creek Subbasin, Lower Lake of the Ozark Hills Subbasin, the Gravois Arm Subbasin, and the Turkey Creek Subbasin. There are no Class IA CAFO facilities within the basin. Additional information on permitted CAFOs can be obtained from the Missouri Department of Natural Resources.

#### **Gravel mining**

Due to the rocky soil types and Ozark characteristics of the streams of this area, gravel is widely distributed throughout the basin. Gravel mining is widely practiced since gravel is easily obtained from stream gravel bars. The mining of gravel from streams is an ongoing, largely unregulated cumulative activity with serious natural resource consequences to biota and geomorphology. The majority of the gravel mining operations in the basin are non-commercial operations and therefore are not required by MDNR to have permits. Some commercial operations do currently exist however, and these are required to have current operating permits with the MDNR. The streams where these facilities are currently permitted to mine gravel are the East Fork Little Gravois Creek (Miller County River Hills Subbasin), Tavern Creek (Tavern Creek Subbasin), Turkey Creek (Turkey Creek Subbasin), and the Osage River (Lower Osage River Subbasin). Additional information on current gravel mining permits can be obtained from the Missouri Department of Natural Resources.

#### Hydroelectric power generation

Two hydroelectric power plants exist in the basin: Truman Dam near Warsaw, MO and Bagnell Dam (Lake of the Ozarks) near Bagnell, MO. Both projects impound the Osage River for the purpose of hydroelectric power generation.. Truman Dam is a public facility owned and operated by the USACE. It has an installed capacity of 160,000 kilowatts. Bagnell Dam is privately owned and operated by AmerenUE. It has an installed capacity of 215,000 kilowatts. Only the Bagnell Dam project is located entirely within the basin. Secondary uses of these dams are flood control and recreation.

#### **Soil Conservation Projects**

Each county Soil and Water Conservation District in the basin has been active in promoting soil and water conservation projects (Table 6). Most of the funds for these projects have come from the Missouri State Parks, Soil and Water Conservation sales tax. The funds for soil and water conservation are administered through the MDNR Soil and Water Conservation Program Types of regular cost-share practices most commonly designed to address soil and water conservation concerns of the basin included the Permanent Vegetative Cover Establishment, Permanent Vegetative Cover Improvement, and the

Permanent Vegetative Cover Enhancement. Types and numbers of projects installed within counties of the basin can be found in Table 7.

In addition to the above regular cost-share projects, select Soil and Water Conservation districts have undertaken special conservation projects which address local soil and water conservation concerns. These projects are called Special Area Land Treatment (SALT) projects and are administered through the MDNR Soil and Water Conservation Program.

Completed SALT projects located within the basin include the Little Maries Creek SALT project of Osage County Soil and Water Conservation District and the Turkey Creek SALT project of Hickory County Soil and Water Conservation District (Table 8, Figure 13). These two SALT projects combined are saving an estimated 39,620 tons of soil and are serving 1,579 acres. An additional Agricultural Non-Point Source SALT (AgNPS SALT) project was approved for Deer Creek by the Benton County Soil and Water Conservation District.

#### **Public Use Areas**

The Missouri Department of Conservation and the Missouri Department of Natural Resources both own and manage public land within the basin. There are a total of 29,721 acres of state-owned public use areas in the basin. This is approximately 1.9% of all acres of the basin.

The MDC owns 19 stream accesses, 11 conservation areas, 11 tower sites, 1 fish hatchery, and 1 community lake within the basin (Table 9, Figure 14). Major MDC areas include Lost Valley Fish Hatchery (970 acres), Big Buffalo Creek Conservation Area (1,555 acres), Painted Rock Conservation Area (1,480 acres), and Saline Valley Conservation Area (4,782 acres). Additional information on all MDC owned public sites may be found at MDC's website.

The MDNR, State Parks Division owns and operates Lake of the Ozarks State Park. This 17,302 acre park is the largest state park in Missouri and offers many recreational activities including fishing, boating, camping, horseback riding, bird watching, and much more.

#### **Corps of Engineers 404 Jurisdiction**

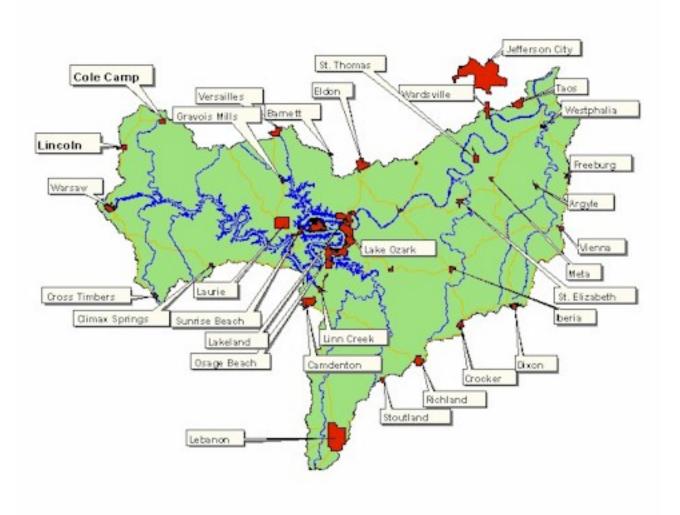
The USACE has authority to oversee and regulate the waterways of the basin. This authority extends to regulation of gravel mining in streams and alteration of wetlands. Most in stream and some stream-side projects require 404 permits. Application for permits should be directed to the U.S. Army Corps of Engineers office in Kansas City, MO. The basin is under the jurisdiction of the Kansas City District of the Northwest Division.

Kansas City District USACE, 700 Federal Building, Kansas City, MO 64106 (816) 426-5357

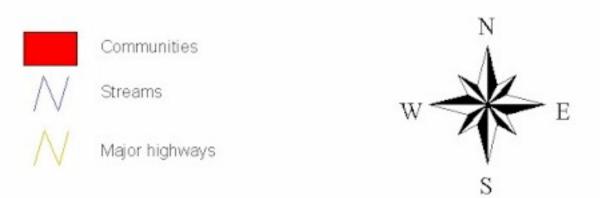
Topographic Coverage

Figure 15 depicts 7.5 minute topographic map coverage of the basin.

Figure 7. Communities of the East Osage River Basin







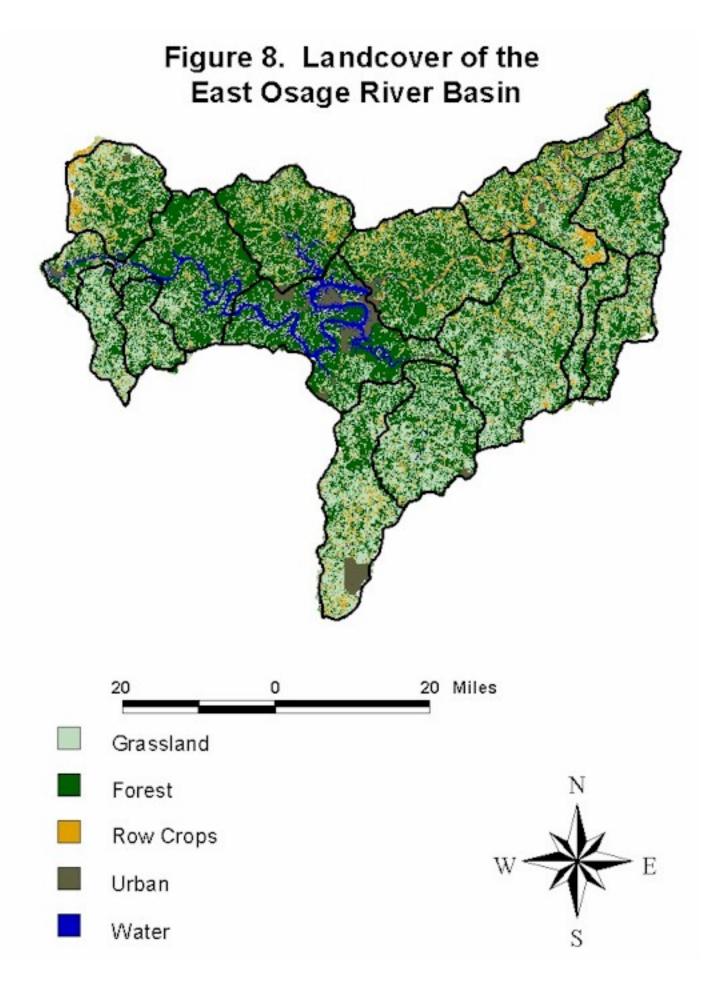


Figure 9. Corn harvested over time for Miller and Camden Counties

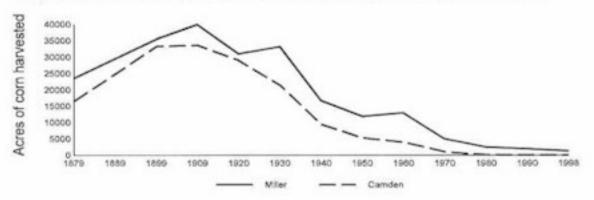


Figure 10. Cattle on farms over time for Miller and Camden Counties

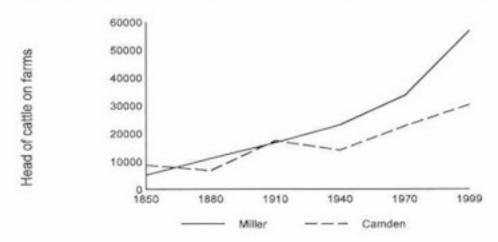
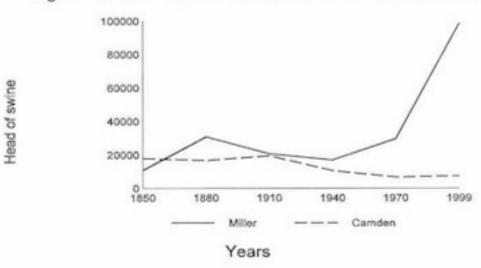
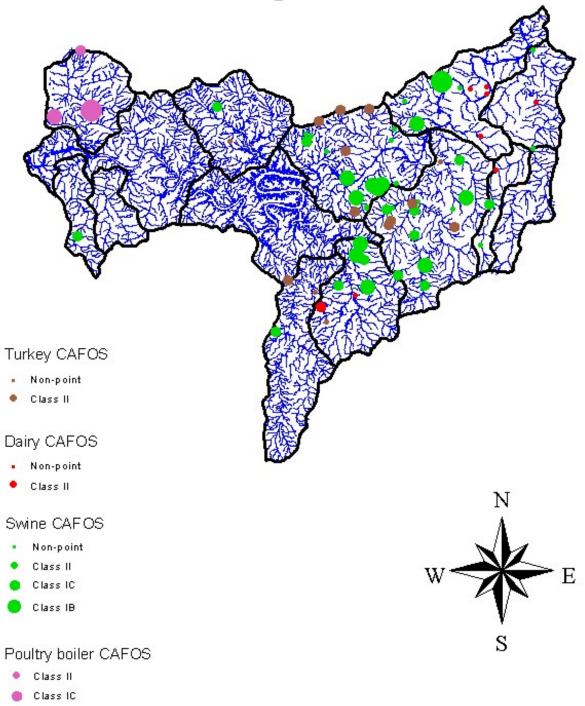


Figure 11. Swine on farms over time for Miller and Camden Counties

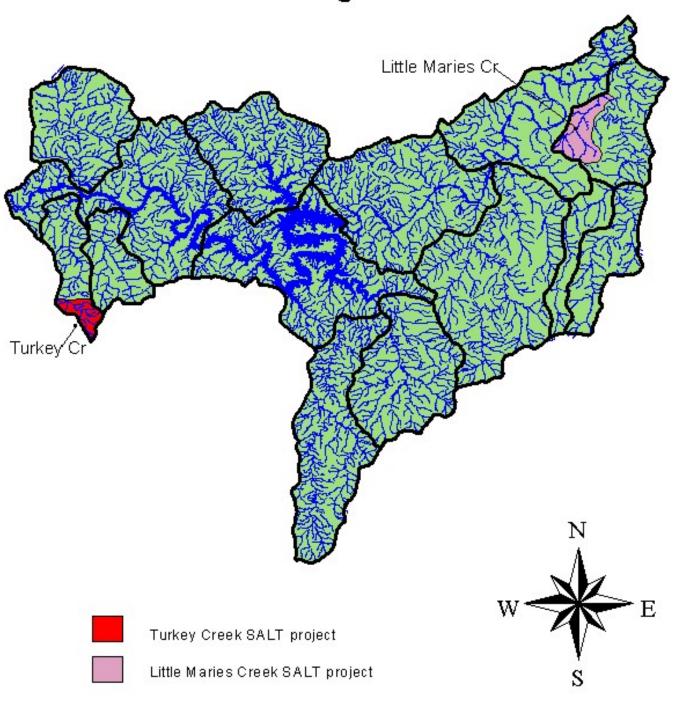


# Figure 12. CAFOS of the East Osage River Basin

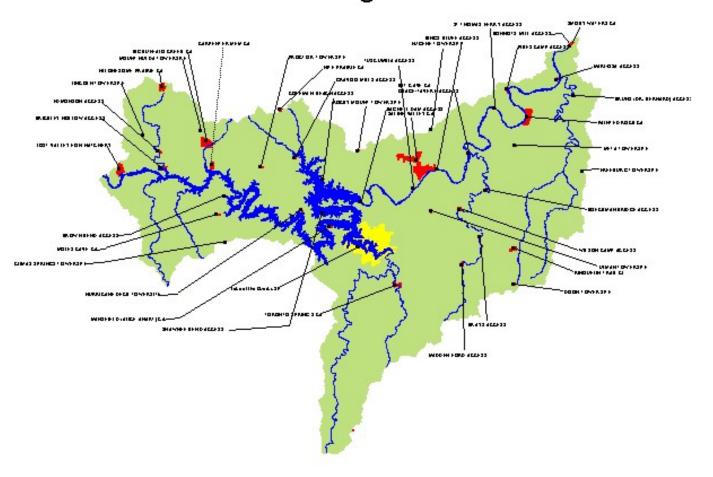


Class IB

Figure 13. Completed SALT projects of the East Osage River Basin



## Figure 14. Public Use Areas in the East Osage River Basin



Missouri Department of Conservation areas



Missouri Department of Natural Resources area

Figure 15. Topographic map coverage of the East Osage River Basin

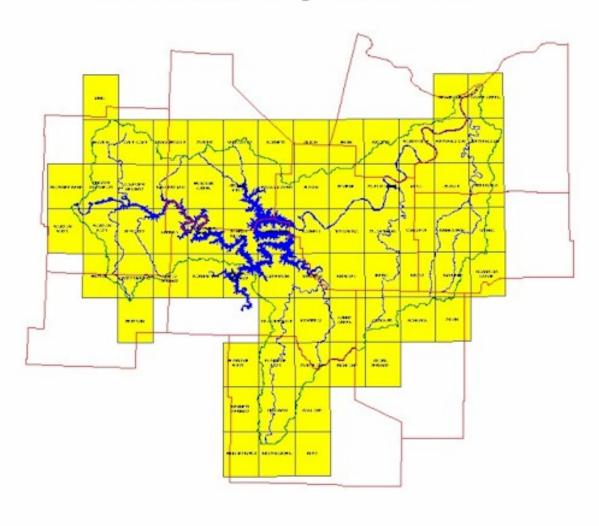






Table 3. Total county populations and estimated changes for Missouri counties that include portions of the East Osage River Basin.

County	1990 Pop.	1995 Pop.	2000 Est.	2005 Est.	2010 Est.	2015 Est.	2020 Est.
Benton	13,859	14,705	15,421	15,992	16,404	16,621	16,629
Camden	27,495	30,950	34,061	36,838	39,135	40,872	41,978
Cole	63,579	66,418	68,761	70,803	72,645	74,244	75,515
Hickory	7,335	7,758	8,103	8,345	8,475	8,499	8,429
Laclede	27,158	28,524	29,834	31,124	32,373	33,593	34,700
Maries	7,976	8,183	8,389	8,587	8,788	8,975	9,122
Miller	20,700	21,710	22,730	23,812	24,897	25,916	26,860
Morgan	15,574	16,433	17,197	17,883	18,456	18,883	19,145
Osage	12,018	11,979	11,929	11,912	11,914	11,923	11,920
Pulaski	41,307	43,816	46,322	48,994	51,836	54,742	57,634
Total	237,001	250,476	262,747	276,295	286,933	296,283	303,952

Source: Missouri State Office of Administration (1998).

Table 4. Largest communities (population >1,000), population\*, county, and subbasin in which they are located for communities in the East Osage River Basin.

COMMUNITY	POPULATION	COUNTY	SUBBASIN	
Cole Camp	1054	Benton	Cole Camp Creek	10290109020
Crocker	1077	Pulaski	Tavern Creek	10290111010
Dixon	1585	Pulaski	Upper Maries River	10290111040
Warsaw	1696	Benton	Upper Lake of the Ozarks Hills	10290109040
Richland	2029	Pulaski	Upper Maries River	10290111040
Versailles	2365	Morgan	Gravois Arm	10290109050
Camdenton	2561	Camden	Dry Auglaize Creek	10290109060
Osage Beach	2599	Miller	Lower Lake of the Ozarks Hills	10290109080
Eldon	4419	Miller	Miller County Osage River Hills	10290111020
Lebanon	9983	Laclede	Dry Auglaize Creek	10290109060

<sup>\*</sup> based on 1990 Bureau of the Census, USDC figures. www.census.gov)

Table 5. Land use/cover for the East Osage River Basin, by HUC (MoRAP 1997).

Land Use/Cover Area (acre		Percent by Land Use/Cover		
	Cole Camp Creek I	HUC		
Forest 45,526 48.				
Grassland	42,260	45.1		
Urban	567	0.6		
Open Water	804	0.9		
Cropland	4,596	4.9		
Barren	42	0.0		
TOTAL	93,795	100		
	Turkey Creek HU	JC		
Forest	18,375	39.9		
Grassland	27,016	58.7		
Urban	250	0.5		
Open Water	315	0.7		
Cropland	67	0.0		
TOTAL	46,022	100		

	Deer Creek HUC			
Forest	24,536	55.0		
Grassland	19,597	43.9		
Open Water	446	1.0		
Cropland	14	0.0		
TOTAL	44,592	100		
Upper I	Lake of the Ozark Hills H	UC		
Forest	113,793	72.1		
Grassland	40,964	25.9		
Urban	1,353	0.9		
Open Water	1,330	0.8		
Cropland	348	0.2		
TOTAL	157,788	100		
	Gravois Arm HUC			
Forest	76,444	66.7		
Grassland	30,789	26.9		
Urban	1,893	1.7		

Open Water	4,706	4.1
Cropland	786	0.7
TOTAL	114,618	
Lower L	ake of the Ozarks Hills H	UC
Forest	99,225	64.4
Grassland	24,079	15.6
Urban	9	0.0
Open Water	30,332	19.7
Cropland	471	0.3
Barren	9	0.0
TOTAL	154,125	100
Miller Co	ounty Osage River Hills H	IUC
Forest	100,419	63.2
Grassland	51,040	32.1
Urban	4,058	2.6
Open Water	229	0.1
Cropland	3,211	2.0

Barren	2	0.0
TOTAL	158,959	100

Table 6. State Soil & Water Conservation Program efforts and accomplishments by county totaled for all years to date.

County	Total number of practices	Total Cost-share	Total Tons of Soil Saved over life span of practices	Acres Served
Benton	441	\$767,680	249,070	4,848
Hickory	755	\$1,243,535	292,308	21,205
Morgan	227	\$364,653	140,948	5,142
Camden	337	\$386,170	100,765	9,149
Miller	319	\$540.698	117,243	5,895
Laclede	697	\$813,347	344,447	17,644
Cole	322	\$483,469	131,726	3,091
Pulaski	5,121	\$7,288,044	2,582,651	111,677
Maries	1,049	\$1,391,303	690,650	24,706
Osage	421	\$621,041	197,129	6,143